AMENDMENTS TO SPECIFICATION

Page 2 (1st Page of Specification), lines 5-11:

The present invention relates to a system and ~~a~~ method for handling ~~the~~ laser-communication multiplexing in chaotic secure communications, and more particularly, for decoding multiplex chaotic laser signals by utilizing a low-pass filter to increase the fractal dimension of the chaotic system, so that ~~the~~ decoding of the multiplex messages encoded by chaotic behaviors can be achieved. The disclosure of the present invention can be applied to many kinds of secure communication systems.

Page 2, lines 15-27:

The technique of multiplex transmission has been well established in the field of conventional laser communications. However, ~~it still lacks~~ there is still no effective scheme ~~of combining~~ for applying such laser multiplexing to chaotic secure communication systems. ~~On the other hand, although it has been addressed~~ Moreover, although it is known that chaotic systems can be applied to secure communications, ~~however,~~ the conventional techniques of simplex-coupled synchronization can only work well in simplex transmission, ~~it appeared some~~ and therefore difficulties arise in handling multiplex transmission. The main reason can be attributed to the nonlinear interaction among the multiplex laser signals, resulting in a superimposed, ~~interfered~~ interfering and complex chaotic system. To resolve these ~~tow~~ two problems, a low-pass filter is utilized to increase the fractal dimension of the multiplex chaotic signals, so that the periodicity of these chaotic signals will be enhanced. This technique can be used to rebuild the multiplexed messages encoded by chaotic behaviors in laser communications.

Page 4, lines 16-20:

As has been ~~approved~~ proven by computer experiments and numerical simulations, the system and the method of the present invention is an effective scheme for handling ~~the~~ laser-communication multiplexing in chaotic secure ~~communications, in which the~~

communications. The system and the method for encoding and decoding the messages to be multiplexed ~~comprise~~ utilizes the following ~~procedures.~~ steps:

Page 4, line 22:

Step 1. ~~Proceeding of chaotic behavior of~~ Driving self-pulsating laser diodes to generate chaotic laser signals.

Page 5, line 7:

Step 2. Synchronization of the ~~simplex-coupled~~ chaotic ~~proceeding~~ laser signals

Page 5, lines 8-20:

Synchronization is the most important technique in communication applications. As shown in FIG. 2, the ~~drive~~ chaotic laser signals, which ~~is~~ are detected by photo detector PD(D), and generated by the transmitter according to the method described in step 1, ~~from the transmitter end~~ can be simplex-coupled to the response chaotic laser signals PD(R) of the receiver end by ~~arranging same coupling coefficients~~ using the transmitter signal to drive the receiver signal and by adjusting the gain of the receiver signal so that the signal-encoded and re-created chaotic signals between the transmitter and receiver ~~end~~ ends can be compared. According to our computer experiments and numerical simulations, for a suitable ~~coupling~~ gain coefficient, the chaotic sequences of the response and the drive systems will be synchronized. This phenomenon is also the basic principle for utilizing these chaotic behaviors ~~to the applications of~~ in secure communications. This synchronization can be further confirmed by using the conditional Lyapunov exponent. The signature of simplex-coupled behavior exhibited between two chaotic systems will ~~prohibit~~ prevent the transmitted messages from being rebuilt by ~~any~~ an unauthorized receptor.

Page 5, line 22:

Step 3. ~~Proceeding of using~~ Using the simplex asymptotical synchronization principle.

Page 5, line 23 to Page 6, line 10:

Asymptotical synchronization is the most important technique for recovering the messages encoded by chaotic carrier. By using the simplex asymptotical synchronization principle, when the chaotic laser light of the transmitter containing messages is delivered to the receiver end, the receiver can reproduce ~~a~~ an asymptotical synchronized chaotic laser light. The carried messages can then be rebuilt by ~~taking~~ applying a fast-Fourier transformation (FFT) to the difference between the output signals of the transmitter and the receiver. This technique is well established for decoding a simplex transmission message. However, for the case of multiplex transmission, due to the complex phenomenon induced by the nonlinear interactions between different multiplex channels, ~~it will appear some difficulties~~ it is difficult to rebuild the transmitted messages by simply ~~taking~~ applying an FFT to the synchronized chaotic systems. This can be seen in FIGs. 4(a), 4(b), 5(a) and 5(b). The messages to be multiplexed are shown in FIG. 4(a) and 4(b), which are the time sequences, *Signal*(t), of the messages to be multiplexed and the corresponding frequency spectrum ~~by taking~~ resulting from application of the FFT to the *Signal*(t), respectively. The difference, $e(t)$, between the output signals of the transmitter and the receiver after synchronisation is displayed in FIG. 5(a). However, as shown in FIG. 5(b), the transmitted messages cannot be rebuilt by simply ~~taking~~ applying the FFT to the difference $e(t)$. Therefore, the decoding of multiplexed messages carried by chaotic signals should further utilized the technique described in the following ~~procedure~~ step.

Page 6, line 12:

Step 4. ~~The~~ Use of a low-pass filter ~~proceeding~~ to transfer chaotic time sequence to higher fractal dimension.

Page 6, line 13 to Page 7, line 4:

This procedure is the most important technique for recovering the multiplexed messages encoded by chaotic signals, which is also the major part of the present invention. As shown in FIG. 3, due to the nonlinear interactions among different multiplex channels,

the multiplex channels, the multiplex signals will interfere and superimpose with each other. Thus, the multiplexed messages cannot be fully recovered, if the conventional method as described in step 3 was used to decode them. To resolve this problem, this invention introduces a low-pass filter 21 to process the chaotic signals after synchronization. As illustrated in FIG. 7, first, the difference, $e(t)$, between the output of the transmitter and the receiver is sent into the low-pass filter. The low-pass filter can be described by the following differential equation,

$$\frac{dy(t)}{dt} = -\alpha y(t) + e(t)$$

where α is the parameter of the low-pass filter and $y(t)$ is the signal after low-pass-filtering. According to out numerical simulations, if the parameter α is in the range of 0.13-0.97, the original chaotic time sequence of lower fractal ~~dimensional~~ dimension will be transferred to a chaotic time sequence of higher fractal dimension. Owing to the higher fractal dimension, the periodicity of these multiplex messages will ~~be emerged~~ emerge and hence the decoding of these multiplexed messages can be achieved. The effects of the low-pass filter can be seen in FIG. 6(a) and (b). By comparing FIG. 6(b) with FIG. 4(b), it is clear that the multiplexed messages have been rebuilt by ~~taking~~ applying the FFT to the signals after being sent through the low-pass filter of the present invention.